Sit. Rep. #05
13 February 2008
US AMLR Vessel Survey (*R/V Yuzhmorgeologiya*)
South Shetlands, Antarctica

The weather cooperated for the remainder of the fur seal survey although no landing could be made at the east side of Elephant Island at Cape Lindsey. Fur seal counts were made at Seal Island and Cape Valentine completing the fur seal population survey. After a successful in port, we have departed from Punta Arenas at 0900 13 February, in transit to Cape Shirreff to drop off freshies [fresh groceries] before transiting to the South Orkney Islands.

Acoustics

Acoustic biomass estimates for the South Area comprising Bransfield Strait showed patchy distribution of krill in the acoustic data. In this area we estimate approximately 850 thousand tons of krill were present. The density of krill in the South Area was about 35 g per m^2. Thus, in total, we estimate more than 3 million tons of krill were present among the four areas of the AMLR survey grid. This compares favorably to last year, but is less than 2 years ago.

Krill and Zooplankton Leg 1 Overview

Mean and median krill abundance in the Elephant Island Area net samples during January 2008 (186 and 22 per 1000 m^3) were the second largest recorded for this season over the past 17 years, ranking second to those of 2003 (319 and 31 per 1000 m^3). The highs in both cases resulted from the cumulative effect of three successive years of strong recruitment success. The large proportions of juveniles collected this season (52% of total krill) rivaled the highest value recorded in 1996 (55%) and surpassed the highs of 2002 and 2003 (42-45%) a testament to the strength of the 2006/07 year class. However, the proportions of juvenile and immature krill this year may have been inflated due to the paucity of larger krill (i.e., >50 mm) that presumably were located north of the survey area. A similar situation was observed in 2003 suggesting that distribution ranges are expanded northward during times when there are abundant one- and two-year-old krill.

Based on the prevalence of female stage 3a and 3b krill and increasing frequency, abundance and advancing larval stages the survey period appeared to coincide with the onset of the krill reproductive effort. While only 25 % of the mature females in the Elephant Island Area were in advanced reproductive stages (i.e., with ovarian development, gravid or spent) it is quite likely that these stages will predominate during early February. The timing of this seasonal reproductive effort, therefore, is probably not unfavorably delayed. The fact that larval abundance in all four survey areas (means 4-156 per 1000 m^3) were substantially greater than those observed the same time last year (2-32 per 1000 m^3) suggests that another year of strong recruitment success may

be anticipated. This would mark the fourth successive year of year class success, a first in the long-term data record. This idea should be confirmed by the concentrations of larvae obtained during the Leg 2 survey.

The zooplankton assemblage in the Elephant Island Area was strongly dominated by copepods, post-larval *Thysanoessa macrura*, postlarval and larval stages of krill, and chaetognaths. The overall composition, absolute and relative abundance of these taxa were remarkably similar to last year as indicated by a high PSI value of 84. These assemblages were also similar to that sampled in 1995 (PSIs both 78) and reflect the strong numerical dominance of copepods and paucity of salps. Both salp species, *Salpa thompsoni* and *Ihlea racovitzai*, were comparatively rare this year. The mean abundance of *S. thompsoni* in the Elephant Island Area this year (8 per 1000 m^3) was the lowest recorded over the past 17 years while the median value (4 per 1000 m^3) rivaled the lows in 1995 and 2007.

Oceanography

The weather deteriorated from the mild conditions experienced in the Bransfield Strait, with Southeasterlies and Southwesterlies above 20 knots for most of the week, when not in the lee of the islands. Monday and Tuesday saw grey skies and snow, clearing later in the week when the wind dropped below 20knots on Friday evening, making for smooth passage across the Drake.

Further deck calibrations of the CTD's PAR sensors were performed, before the system was stripped down for servicing prior to Leg 2. Final CTD/salinometer comparison figures were entered, showing close agreement between the two instruments. CTD/thermosalinograph comparison figures were also obtained.

The SCS data for the survey area and the south to north transit were merged, filtered and the position of the convergence determined. The convergence had shifted north, from around 58° 11' S (12th January) to 57° 20' S (8th February).

Phytoplankton (REPEAT)

Phytoplankton survey completed without complications, 100 stations sampled. Total of 15 stations sampled for iron concentrations; 31 stations sampled for macronutrient concentrations at 6 depths (10, 30, 50, 75, 100, and 200 meters) with 10 additional stations sampled for macronutrient concentrations in the upper mixed layer; 27 stations sampled for phytoplankton abundances (microscope) in the upper mixed layer. Eleven stations had upper mixed layer depths less than 30 meters, averaging 1.3 mg chlorophyll-a m^{-3}; 19 stations had upper mixed layer depths more than 100 meters, averaging 0.7 mg chlorophyll-a m^{-3}. Mean chlorophyll-a in the upper mixed layer were 0.8 mg chlorophyll-a m^{-3} for all stations sampled, with highest concentrations measured in the Bransfield Strait, with 3 high biomass stations located north of Elephant Island. Lowest chlorophyll-a concentrations (<0.3 mg m^{-3}) were measured in the Drake Passage, while cold, saline waters from the Weddell Sea outflow into the Bransfield Strait (near Joinville Island) also had low concentrations (0.3-0.8 mg chlorophyll m^{-3}). Chlorophyll-a in the upper mixed layer for the West Area was found to have 0.58 ± 0.61

mg m^{-3}; the Elephant Island Area was found to have 0.73 ± 0.51 mg chlorophyll-a m^{-3}; the Joinville Island Area was found to have 0.99 ± 0.59 mg chlorophyll-a m^{-3}; and the South Area was found to have 1.02 ± 0.43 mg chlorophyll-a m^{-3}. Highest fluorescence yields were measured in blue Drake Passage waters north of the continental margin and west of Elephant Island. The Bio-Optical sampling has been completed for the cruise.

The Integrated Optics Package (IOP) and the Profiling Reflectance Radiometer system (PRR) were deployed at a total of 15 mid day CTD stations. Complementary water samples were taken at 16 mid day stations allowing for 32 PvsE experiments and sampling of 77 depths for ap, ad, and as analysis, measurement of particle number and size distribution, and particulate CHN. HPLC pigments samples were collected at 99 stations at surface and subsurface chlorophyll maximum. The surface PRR 810 continues to record surface irradiance at 19 spectral channels. Mati Kahru has continued to provide ocean color satellite image support. The composite image for the second half of January indicates the surface chlorophyll a concentrations in Bransfield Straight and east of the Shackelton Transverse Ridge largely decreased compared to the first half of month. AMLR'08 Leg 1 survey sampled the end of a bloom.

Seabirds and Marine Mammal Observations (REPEAT)

Data on the distribution, abundance and behavior of seabirds and mammals were collected during underway ship operations in the Elephant Island, Joinville and South strata. 30 transects were collected covering approximately 610 nautical miles of survey effort. We found that feeding aggregations of Cape petrels were spatially associated with a strong sea-surface temperature front that traversed the Elephant Island region. A southern right whale was observed on the last transect in the Elephant Island region adjacent to Clarence Island. This is the first time this species has been observed in the AMLR region since 2004. The seabird community in the Joinville Island strata consisted of (percentage-wise): Adélie penguin, southern fulmar, chinstrap penguin, Wilson's storm petrel, southern giant petrel, and Antarctic petrel. 59 humpback whales and 3 fin whales were observed. Additionally, Antarctic fur seal, crabeater seal, Weddell seal and leopard seal were observed in the Joinville area. The seabird community in the South strata consisted of (percentage-wise): Adélie penguin, chinstrap penguin, southern fulmar, Wilson's storm petrel, Cape petrel, gentoo penguin, southern giant petrel and black-browed albatross. A very unusual sighting of a king penguin was observed on 31 January at 62.5 S, 56 W. A total of 77 humpback whales and 2 minke whales were observed in the South stratum. Antarctic fur seals were highly conspicuous in the South stratum, with the highest numbers occurring near the ice edge in the vicinity of the Antarctic Sound and Joinville Island.